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Description

Vacuum contactor

- 5 The present invention relates to a vacuum contactor having a contactor housing, a drive coil, an armature, an operating element and at least one vacuum contact,
- with the drive coil deflecting the armature from an armature rest position to an armature operating position when a pull-in current is applied,
 - 10 - with the deflection of the armature causing the operating element to be deflected from an element rest position to an element operating position, and
 - 15 - with the deflection of the operating element resulting in closing of the at least one vacuum contact.

- CH-A-169 467 discloses a vacuum contactor having a contactor housing, a drive coil, an armature, an operating element and at least one vacuum contact,
- with the drive coil deflecting the armature from an armature rest position to an armature operating position when a pull-in current is applied,
 - 25 - with the deflection of the armature causing the operating element to be deflected from an element rest position to an element operating position,
 - with the deflection of the operating element resulting in opening of the at least one vacuum contact,
 - 30 - with, when the armature is deflected from the armature rest position to the armature operating position, the armature first of all passing through an initial movement distance, and then
 - 35 passing through a driving movement distance, and

- with the drive coil deflecting the armature from an armature rest position to an armature operating position when a pull-in current is applied,
- with the deflection of the armature causing the operating element to be deflected from an element rest position to an element operating position,
- with the deflection of the operating element resulting in closing of the at least one contact,
- with, when the armature is deflected from the armature rest position to the armature operating position, the armature first of all passing through an initial movement distance, followed by a driving movement distance, and
- with the operating element being deflected by the armature only while the latter is passing through the driving movement distance.

In contactors, the armature, and, together with the armature, the operating element are generally deflected
20 against a spring force when the pull-in current is applied to the drive coil. The spring force thus acts in the direction of the armature rest position and of the element rest position. This spring force must be overcome by the pull-in torque which the drive coil
25 exerts on the armature as a result of the pull-in current. The pull-in torque is dependent on the pull-in current, which is in turn dependent on the supply voltage that is supplied to the drive coil.

30 Both the pull-in torque and the spring force in the opposite direction vary along the distance through which the armature and the operating element are deflected. If the contactor is not well designed, it is

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thus possible for a situation to occur in which, if the supply voltage is too low, although the armature and the operating element are deflected from their rest positions, the armature and the operating element are not deflected to their operating positions, however. In a case such as this, the armature and operating element either remain stuck in an intermediate position, or a contact which is operated by the operating element is only operated without a pressure. Depending on the duration of this state, this can lead to high wear, and generally also to damage, while in the extreme case, it can even lead to destruction of the contactor.

In the case of air contactors, that is to say in contactors whose contacts are surrounded by air, it is possible to design these contactors such that the armature and operating element are either not deflected at all from their rest positions or else are moved completely to their operating positions. Such a contactor characteristic is referred to as a tripping characteristic.

10 Vacuum contactors require a greater spring force in the
opposite direction than air contactors. This is because
the vacuum pressure forces which would initiate
autonomous operation of the contacts must be overcome.
Until now, for vacuum contactors, it has been regarded
15 as being impossible to achieve a tripping
characteristic just on the basis of the
mechanical/electrical design of the contactor. Vacuum
contactors according to the prior art therefore either
do not have a tripping characteristic or else drive
20 electronics are connected upstream of the drive coil
and apply the supply voltage to the drive coil only
when the supply voltage is high enough to ensure that
the armature and operating element will reliably be
moved to the operating positions.

25 However, the inventors of the present invention have identified the fact that, if the vacuum contactor is designed in a suitable manner, it is possible to achieve a tripping characteristic even without any
30 upstream drive electronics. The inventors of the present invention have therefore created a vacuum contactor in which the operating element always either remains in the element rest position or is deflected

completely to the element operating position when a current that is less than the pull-in current is applied to the drive coil.

- 5 This is because the force which needs to be overcome along the initial movement distance can be chosen independently of the contact arrangement and, in particular, independently of the fact that vacuum contacts are being operated. This allows a tripping
10 characteristic to be achieved, if the vacuum contactor is designed in a suitable manner.

- In vacuum contactors, arcs are quenched even with small contact openings. Vacuum contactors therefore generally
15 have shorter switching movements than air contactors. The dimensions that are known for air contactors can thus be used, provided the sum of the initial movement distance and the driving movement distance correspond to the contact movement distance of an air contactor.
20 In practice, this corresponds to the ratio of the initial movement distance to the driving movement distance being between 1:3 and 3:1. In general, the ratio of the initial movement distance to the driving movement distance is between 2:3 and 3:2.

- 25 As already mentioned, the armature is deflected against an initial movement force while it is passing through the initial movement distance, and against a driving force while it is passing through the driving movement
30 distance. A tripping characteristic can be achieved in a particularly highly reliable manner if the initial movement force is less than the driving force. In practice, this normally means that the ratio of the initial movement force to the driving force is between

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spring device 7 presses the operating element 4 against a housing stop 10. The contact-making spring device 8 presses the contact link 5 against a contact link stop 11. The armature 3 is thus in an armature rest position AR, the operating element 4 is in an element rest position ER, and

The deflection of the operating element 4 results in contact pieces 13 on the contact link 5 being lowered, as illustrated in Figure 2, onto mating contacts 14, which are arranged fixed in the contactor housing 1.

- 5 The operating element 4 is then also deflected somewhat further, so that, during the last section of the movement through

The initial movement force FV is less than the driving force FM. As a rule, it is 10% to 50% of the driving force FM. The ratio of the initial movement force FV to the driving force FM is thus generally 1:10 to 1:2. The initial movement force FV is preferably between 20% and

25% of the driving force FM, and the ratio is thus preferably between 1:5 and 1:4.

5 It can also be seen from Figure 3 that the operating element 4 is deflected by the armature 3 only while the latter is passing through the driving movement distance sM. As a rule, the initial movement distance sV is

25% to 75% of the overall movement distance that the armature 3 passes through. In general, it is between 40% and 60% of the total movement distance. The ratio of the initial movement distance s_V to the driving movement distance s_M is thus generally between 1:3 and 3:1, and is normally between 2:3 and 3:2.

The driving force F_M is governed essentially by the dimensions of the vacuum contact - or the vacuum contacts if there are a number of contacts to be switched. The initial movement force F_V can, in contrast, in principle be chosen as required. Thus, in particular, it is possible to design the initial movement force F_V to be similar to that in an air contactor with the same rating.

The driving movement distance s_M is likewise governed essentially by the dimensions of the vacuum contactor. The initial movement distance s_V can once again be chosen as required. In particular, the initial movement distance s_V can be chosen such that the sum of the initial movement distance s_V and of the driving movement distance s_M corresponds to the movement distance through which the armature and the operating element of a comparable air contactor are moved. The drive coil 2 can thus be designed in the same way as for a comparable air contactor. This makes it possible, in particular, to achieve a vacuum contactor with a good tripping characteristic.